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ABSTRACT

The 1979-1980 class schedules for the nine institutions within the Los Angeles Community College District were examined to document the number and variety of courses offered by the colleges in six areas of science: agriculture, biological sciences, engineering sciences and technology, mathematics and computer science, physical sciences, and social sciences. Specifically, this analysis sought to determine the percentage of class sections devoted to the sciences, the percentage of science courses with prerequisites, and the instructional format used in these classes (e.g., lecture or lab). It also sought to establish the number of science courses falling under four audience categories: (1) general introductory courses for non-majors; (2) courses designed for science majors who need to satisfy lower-division science requirements; (3) courses for students in science-related occupational courses; and (4) preparatory courses designed to ready underskilled students for introductory science courses. Major findings reveal that science courses made up 24% of the District's curriculum. Almost half of the science classes (48%) were designed as general introductory courses, while 19% were for science majors and another 19% were for vocational students. Prerequisites existed for 47% of the courses, and 68% of the class sections were offered only in lecture format. The study report details findings by campus for each of the science areas. (JP)

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THE SCIENCE CURRICULUM IN THE LOS ANGELES COMMUNITY COLLEGE DISTRICT

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Center for the Study of Community Colleges

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THE SCIENCE CURRICULUM IN THE LOS ANGELES COMMUNITY COLLEGE DISTRICT

Jack Friedlander
and
Donna Sillman

How can community colleges attract more students to the sciences? To find an answer, the National Science Foundation has sponsored a study of science education in the Los Angeles Community College District. One component of this study involved an analysis of class schedules for the 1979-80 academic year to document the number and variety of courses offered at each of the nine District Colleges in agriculture, the biological sciences, engineering sciences and technologies, mathematics and computer sciences, the physical sciences, and the social sciences. This analysis considered the percentage of:

*the total curriculum devoted to science;

*the classes offered in the sciences designed for students desiring a general introductory course;

*the classes offered in the sciences for students majoring in science;

*the classes offered in science for those participating in science-related occupational programs;

*the classes offered in science designed for students needing special preparation prior to entering an introductory course in the field;

*the science courses with prerequisites;

*the science courses presented in lecture section only, laboratory section only, lecture and laboratory sections, independent study, or some other format

The data are reported by college for the biological sciences (p. 4), physical sciences (p. 6), mathematics (p. 8), engineering sciences and technologies (p. 11), social sciences (p. 14), and agricultural sciences (p. 16). Results for the District are summarized on pages 17 and 18.

Method

Catalogs for the academic year 1979-80 and class schedules for Fall, 1979 and Spring, 1980 were obtained from each of the nine District Colleges. The college catalogs were consulted in order to obtain descriptions of the courses in terms of their prerequisites, contents, and students served. The class schedules were examined so as to gain a more accurate count of what courses were being offered than could have been ascertained from the college catalogs alone.

Information for this study was obtained by counting all science class sections in the nine District College class schedules for Fall 1979 and Spring 1980 for each of the science disciplines. All courses appearing in the class schedules were placed into one of four categories on the basis of their content and intended audience (e.g., major field, educational objective, educational background of student in that area). Descriptions of the four course orientation categories are presented below.

General introductory courses. The courses included in this category are designed to introduce students to subject areas in science. These courses may be taken to fulfill a general educational requirement and are not intended for students in science programs. Courses in this category differ from those designed for science majors in the following respects: (1) they are not prerequisites for any other course; (2) practical applications are stressed more than theory; and (3) the college's curriculum includes a more intensive course in the same area.

Courses for science majors. These courses are designed to satisfy lower division science requirements for students in science programs. The introductory courses are for introducing science majors to scientific principles and concepts and are prerequisites for more advanced courses. Those courses specifically designed for science majors are designated by an introductory science prerequisite and they treat subject matter in depth.

Courses for students in science-related occupational programs. Courses in this category are designed for students intending to complete programs in science-related occupational and technology programs. Major scientific principles related to an occupational field as well as scientific terminology are introduced.

Preparatory courses. This category consists of courses to prepare students for introductory college-level courses in science. They are designed for students with inadequate backgrounds in some area of science. These courses provide students with the knowledge and skills needed in the introductory college-level science courses.

Results

Percentage of Total Curriculum Devoted to Science. Overall, 24 percent of the class sections offered in the District in 1979-80 were in science. The highest concentration of science offerings was at Pierce where 40 percent of the class sections listed in the 1980 class schedules were in science. Other colleges that were above the District average in the percentage of class sections devoted to science were Valley (28%), East (25%), and West (25%).

Percentage of Total Class Sections in Science

District	Pierce	Valley	East	West	City	Harbor	Southwest	Mission	Trade
24	40	28	25	25	22	21	21	14	10

THE BIOLOGICAL SCIENCES

Definition. The biological science category was comprised of courses in biology, botany, zoology, entomology, ecology and environment, and related topics such as nutrition and pharmacology.

Percentage of total class sections devoted to the biological sciences. Two percent of all class sections offered in the District during the academic year 1979-80 were in the biological sciences.

Percentage of Total Class Sections in the Biological Sciences

District	Pierce	Southwest	City	West	East	Harbor	Mission	Valley	Trade
2	4	4	3	3	2	2	2	2	1

Intended audiences for biological science courses. There were 518 class sections of biological sciences presented in the District in 1979-80. Fifty percent of these class sections were designed for students majoring in the sciences; 34 percent were offered as general introductory courses primarily for non-science majors; and 17 percent of the class sections in the biological science were developed for students in occupational-technical programs. None of the colleges offered preparatory courses for students who lacked basic skills and knowledge needed to succeed in biological science courses.

Percentage of Biological Science Class Sections Offered for Different Groups of Students

	Orientation of Course			
	Science Majors	General Introduction/ Non-Science Students	Occupational Programs	Preparatory
District	50	34	17	0
City	74	26	0	0
Trade	74	26	0	0
Mission	60	33	7	0
Harbor	52	30	18	0
Pierce	51	38	11	0
East	46	35	19	0
Valley	37	32	40	0
Southwest	35	41	25	0
West	18	43	39	0

Prerequisites. A prerequisite was required for entrance into 37 percent of all class sections offered in the biological sciences. The percentage of class sections in the biological sciences with prerequisites at each of the District Colleges are listed below.

Percentage of Class Sections in the Biological Sciences with Prerequisites

District	East	Mission	Pierce	Southwest	City	West	Valley	Trade	Harbor
37	81	60	42	42	30	24	19	15	14

Course format. Seventy-three percent of all class sections offered in the biological sciences included both lecture and laboratory sections. The remaining class sections were presented through lecture sections only (16%), laboratory sections only (7%), independent studies (3%), or some other format (1%).

Course Format of Class Sections in the Biological Sciences

	Lecture and Lab Sections	Lecture Section Only	Lab Section Only	Independent Study	Other
District	73	16	7	3	1
Trade Tech	100	0	0	0	0
East	95	5	0	0	0
Mission	93	7	0	0	0
Valley	87	4	0	9	0
Southwest	74	16	7	3	0
Pierce	70	22	6	0	2
City	68	28	2	0	2
Harbor	68	16	4	12	0
West	27	27	46	0	0

THE PHYSICAL SCIENCES

Definition. The physical sciences category was comprised of courses in chemistry, geography, geology, other earth and space sciences, physics, interdisciplinary physical sciences, and environmental sciences and technologies.

Percentage of total class sections devoted to the physical sciences. Five percent of all class sections offered in the District in 1979-80 were in the physical sciences. The greatest proportions of the curriculum devoted to the physical sciences were found at Pierce (9%), East (6%), and Valley (6%).

Percentage of Total Class Sections in the Physical Sciences

District	Pierce	East	Valley	City	Harbor	West	Mission	Trade	Southwest
5	9	6	6	5	5	5	3	3	2

Intended audiences for courses in the physical sciences. There were 1,144 class sections in the physical sciences offered in the District in 1979-80. Sixty percent of these class sections were designed as general introductory courses for non-science majors; 18 percent were intended for students majoring in science; 10 percent were geared for students in occupational programs; and 13 percent were for students needing preparation in the physical sciences before entering introductory courses in which a fundamental background in the physical sciences was assumed.

Percent of Class Sections in the Physical Sciences Offered for Different Groups of Students

College	Orientation of Course: General Introduction/ Non-Science Students	Science Majors	Preparatory	Occupational Programs
District	60	18	13	10
Mission	69	23	8	0
East	67	14	9	10
Valley	66	22	12	6
West	64	23	13	1
Harbor	61	16	10	13
Pierce	61	17	8	15
Southwest	58	16	13	13
City	52	15	31	2
Trade Tech	46	22	7	24

Prerequisites. There was a prerequisite required for entrance into 47 percent of the class sections in the physical sciences. Class sections with a prerequisite ranged from a high of 81 percent at Mission to a low of 37 percent at Valley.

Percentage of Physical Science Class Sections With Prerequisites

District	Mission	Southwest	City	Trade	West	Harbor	Pierce	East	Valley
47	81	71	61	59	53	41	40	38	37

Course format. A lecture-only format was used in 53 percent of the class sections in the physical sciences. The instructional format of the remaining classes in the physical sciences was as follows: combination of lecture and laboratory sections--35 percent; laboratory section only--ten percent; independent study--one percent; and other--one percent.

Course Format of Class Sections in the Physical Sciences

College	Lecture Only	Lecture Laboratory	Laboratory Only	Independent Study	Other
District	53	35	10	1	1
City	70	26	1	4	0
Mission	58	31	0	0	11
Valley	58	35	4	3	0
West	54	35	10	1	0
Pierce	52	26	21	0	1
Harbor	49	39	12	0	0
East	49	47	1	0	3
Trade Tech	24	49	27	0	0
Southwest	16	65	6	0	13

MATHEMATICS

Definition. This category included all introductory through advanced mathematics courses; mathematics for engineering, technology, and trade students; mathematics for liberal arts, education, and business students; statistics; and computer science courses.

Percent of total class sections devoted to mathematics. Seven percent of all courses offered in the District in 1979 - 80 were in mathematics. The largest proportion of the curriculum devoted to mathematics was found at Pierce (11%) and Valley (9%).

Percentage of Total Class Sections in Mathematics

District	Pierce	Valley	City	East	Harbor	Southwest	West	Mission	Trade
7	11	9	6	6	6	6	6	3	3

Intended audiences for mathematics courses. There were 1,418 class sections in mathematics offered in the District. Forty-three percent of these class sections were designed for students with weak backgrounds in areas of mathematics typically covered in high school. The percentage of mathematics class sections offered in each of the other course-orientation categories was as follows: general introductory college mathematics -- 37 percent; mathematics for students in occupational programs -- 12 percent; and mathematics for math and science majors -- 8 percent. The percentages of mathematics class sections available in the course orientation categories for each of the District Colleges are presented below.

Percentage of Mathematics Class Sections Offered for Different Students

Orientation of Course

College	Preparatory/ Pre-College	General -- Introductory	Occupational Programs	Math or Science Majors
District	43	37	12	8
Southwest	75	19	0	6
Mission	71	25	0	4
East	57	21	10	12
Harbor	57	29	6	8
Trade	51	20	28	1
Valley	39	52	6	3
Pierce	36	40	13	12
West	30	58	4	8
City	23	38	28	11

Prerequisites. There were prerequisites required for entry into 62 percent of the class sections in mathematics.

Percentage of Mathematics Class Sections with Prerequisites

District	West	Mission	Pierce	Valley	East	Harbor	Southwest	City	Trade
62	78	67	66	64	62	61	50	56	51

Course format. The lecture section only format was used in 89 percent of the mathematics sections. Ten percent of the classes had a lecture-laboratory section component. One percent of the offerings were presented in a mathematics laboratory. The combination lecture and laboratory section format was used in over 20 percent of the mathematics class sections at Pierce and City. Trade Tech was the only District College in which students' could take an entire course in a mathematics laboratory.

Course Format of Class Sections in Mathematics

College	Lecture Section Only	Lecture and Lab. Section	Mathematics Lab	Independent Study
District	89	10	1	0
Mission	100	0	0	0
Southwest	100	0	0	0
West	99	1	0	0
Valley	98	2	0	0
East	95	5	0	0
Harbor	94	6	0	0
Trade	85	7	8	0
City	79	21	0	0
Pierce	77	22	0	1

ENGINEERING SCIENCES AND TECHNOLOGIES

Definition. The engineering sciences and technologies category consisted of courses in engineering; engineering graphics and design; civil engineering technology; electrical/electronic engineering and technology; materials; mechanical engineering; industrial engineering; aeronautical, automotive, and combustion engineering; and other engineering and technology fields.

Percentage of total class sections devoted to engineering. Two percent of all class sections presented in the District during the academic year 1979 - 1980 were in the engineering sciences and technologies (engineering). The percentages of class sections given in engineering were highest at Valley (4%), East (3%), and Pierce (3%) and lowest at Southwest (1%) and Mission (0).

Percentage of Total Class Sections in Engineering

District	Valley	East	Pierce	City	Harbor	Trade	West	Southwest	Mission
2	4	3	3	2	2	2	2	1	0

Intended audiences for courses in engineering. Of the 506 engineering class sections offered in 1979-80, 97 percent were designed for students intending to complete programs in science-related occupational and technology programs. General introductory courses accounted for the remaining three percent of the class sections in engineering. None of the District Colleges offered preparatory courses for students who lacked basic skills needed to succeed in introductory engineering courses.

Percent of Class Sections in Engineering Offered for Different Groups of Students

College	Orientation of Course: Occupational Programs	General -- Introduction	Science Majors	Preparatory
District	97	3	0	0
Southwest	100	0	0	0
Trade Tech	100	0	0	0
West	100	0	0	0
Pierce	99	1	0	0
Harbor	98	2	0	0
East	96	4	0	0
City	94	6	0	0
Valley	94	6	0	0
Mission	0	0	0	0

Prerequisites. A prerequisite was required for entrance into 61 percent of the class sections in engineering.

Percentage of Engineering Class Sections with Prerequisites

District	City	East	Trade	Valley	West	Harbor	Pierce	Southwest	Mission
61	90	90	87	77	70	61	56	54	---

Course format. A combination lecture-laboratory section was used for 45 percent of the class sections in engineering. The course format used for the other engineering offerings was as follows: laboratory section only - 27 percent; lecture section only - 25 percent; and independent study - 3 percent.

Course Format of Engineering Class Sections

College	Lecture and Laboratory Sections	Laboratory Section Only	Lecture Section Only	Independent Study
District	45	27	25	3
City	81	9	10	0
West	77	0	23	0
Valley	54	18	28	0
Harbor	49	48	3	0
Southwest	31	31	38	0
Trade Tech	30	35	35	0
Pierce	27	36	37	0
East	22	34	30	14
Mission	--	--	--	--

THE SOCIAL SCIENCES

Definition. The social sciences category was made up of courses in anthropology, economics, interdisciplinary social sciences, psychology, and sociology.

Percentage of total class sections devoted to the social sciences. Six percent of all the class sections offered in the District were in the social sciences. The percentage of class sections given in the social sciences ranged from a high of ten percent at Pierce to a low of one percent at Trade Tech.

Percentage of Total Class Sections in the Social Sciences

District	Pierce	East	Southwest	West	Valley	City	Mission	Harbor	Trade
6	10	8	8	8	7	6	6	5	1

Intended audience for social science courses. There were 1,382 social science class sections offered in the District during the academic year 1979-1980. Seventy-five percent of these class sections were presented as general introductions to an area in the social sciences; the remaining 25 percent were intended for students majoring in some area of the social sciences. None of the social science courses was designed for students in occupational programs or for students in remedial or developmental programs.

Percentage of Social Science Class Sections Offered for Different Groups of Students

Orientation of Course

College	General-Introduction/ Non-Science Students	Social Science Majors	Occupational Programs	Preparatory
District	75	25	0	0
Valley	90	10	0	0
East	83	17	0	0
Harbor	79	21	0	0
Southwest	79	21	0	0
Trade Tech	71	29	0	0
City	70	30	0	0
Mission	67	33	0	0
West	66	34	0	0
Pierce	62	38	0	0

Prerequisites. A prerequisite was required for entry into 27 percent of the class sections in the social sciences.

Percentage of Class Sections in the Social Science with Prerequisites

District	Trade	City	Southwest	Pierce	Harbor	Mission	East	Valley	West
27	43	30	30	29	28	27	25	25	18

Course format. The lecture only format was used in 99 percent of all class sections in the social sciences. The remaining one percent of the social sciences class sections were offered as independent studies.

Course Format of Class Sections in the Social Sciences

College	Lecture Only	Independent Study
District	99	1
Harbor	100	0
East	100	0
Mission	100	0
Southwest	100	0
Trade Tech	100	0
West	100	0
City	99	1
Valley	97	3
Pierce	96	4

THE AGRICULTURAL SCIENCES

Definition. The agricultural sciences category consisted of courses in agriculture, animal science, plant science, soil science, natural resources, forestry, wildlife and wildlands, and food science.

Percentage of total class sections devoted to the agricultural sciences. Less than one percent of all class sections offered in the District in 1980 were in agriculture. Nearly all of the agricultural science courses in the District were given at Pierce, where four percent of all class sections were in the agricultural sciences.

Intended audiences for courses in the agricultural sciences. Sixty-six percent of the class sections in the agricultural sciences were designed for students in science-related occupational programs. Class sections intended for science majors accounted for 24 percent of all offerings in the agricultural sciences; 11 percent of the class sections were for students desiring a general introduction to a field within the agricultural sciences.

Prerequisites. A prerequisite was required for entrance into 31 percent of the class sections in the agricultural sciences.

Course format. Fifty percent of the class sections in the agricultural sciences were presented through a combination of lecture and laboratory sections. The course format used for the remaining class sections in the agricultural sciences were as follows: independent study - 23 percent; lecture section only - 21 percent; laboratory section only - 5 percent.

Summary of Findings

The major findings obtained in the study of the science curriculum in the Los Angeles Community College District are presented below.

Percentage of total curriculum devoted to science. Nearly one out of every four class sections offered in the District in 1979-80 was in science. The percentages are listed below.

All Sciences	Mathematics	Social Sciences	Physical Sciences	Biological Sciences	Engineering Sciences	Agriculture
24	7	6	5	2	2	41

Intended audience for science courses. Close to 50 percent (48%) of all class sections in the sciences were designed as general introductory courses. Courses intended for students majoring in the sciences and courses developed for students intending to complete programs in science-related occupational programs each accounted for 19 percent of the class sections in science. Fourteen percent of the science offerings were designed for students needing preparation in the sciences before entering introductory courses in which a fundamental background in science was assumed.

Percentage of Science Class Sections Offered for Different Groups of Students

	Orientation of Course			
	General Introduction/ Non-Science Students	Science Majors	Occupational Programs	Preparatory
District	48	19	19	14
Social Sciences	75	25	0	0
Physical Sciences	60	18	10	13
Mathematics	37	8	12	43
Biological Sciences	34	50	17	0
Agricultural Sciences	11	24	66	0
Engineering Sciences	3	0	97	0

Prerequisites. A prerequisite was required for entry into 47 percent of the class sections in the sciences. The percentage for each of the sciences is listed below:

Percentage of Class Sections in the Sciences with Prerequisites

All Sciences	Mathematics	Engineering Sciences	Physical Sciences	Biological Sciences	Agricultural Sciences	Social Sciences
47	62	61	47	37	31	27

Course format. Sixty-eight percent of all class sections offered in the District were presented through a lecture section only format. A combination lecture-laboratory section was used for 24 percent of the classes. Other course formats were: lecture section only--six percent; independent study--two percent; some other format--less than one percent. The percentages for each of the six science areas are presented below.

Course Format of Class Sections in the Sciences

	Lecture Section Only	Lecture and Lab Section	Lab Section Only	Independent Study	Other
District	68	24	6	2	<1
Social Sciences	99	0	0	1	1
Mathematics	89	10	1	0	0
Physical Sciences	53	35	10	1	0
Engineering	25	45	27	3	1
Agriculture	21	50	5	23	0
Biological Sciences	16	73	7	3	0

SUMMARIES OF NATIONAL STUDIES OF SCIENCE CURRICULUM AND INSTRUCTION IN COMMUNITY COLLEGES

The Center for the Study of Community Colleges has recently completed a series of studies designed to examine curriculum and instruction in the sciences, social sciences, mathematics, and tehcnologies in America's two-year colleges. In the project, sponsored by the National Science Foundation (NSF), three major research activities were undertaken: a literature review was conducted of the most important studies that have been reported in each of the NSF-included disciplines in the past 15 years (1963-1978); curriculum data were gathered for the 1977-1978 academic year from catalogs and class schedules of a representative national sample of 175 community/junior colleges; teaching practices were ascertained from the random sample of 1,275 science instructors.

The literature, methodologies, and findings related to science curriculum, instruction, and faculty characteristics are reported in the monographs listed below.

Beckwith, Miriam. Agriculture and Natural Resources in Two-Year Colleges Los Angeles: Center for the Study of Community Colleges, 1979. ED 180 567.

Beckwith, Miriam. Anthropology and Interdisciplinary Social Sciences in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 181 955.

Beckwith, Miriam. Mathematics and Computer Science in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 187 386.

Edwards, Sandra J. Biology in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 188 709.

Edwards, Sandra J. Earth and Space Science in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 180 535.

Edwards, Sandra J. Interdisciplinary and Environmental Sciences in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. 180 558.

Friedlander, Jack, and Edwards, Sandra J. Engineering in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 191 538.

Friedlander, Jack. Economics Education in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 188 719.

Hill, Andrew. Psychology Education in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 181 972.

Hill, Andrew. Sociology Education in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 180 572.

Mooney, William. Chemistry in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 187 397.

Mooney, William. Physics in Two-Year Colleges. Los Angeles: Center for the Study of Community Colleges, 1979. ED 191 537.

REPORTS AVAILABLE ON SCIENCE EDUCATION IN THE LOS ANGELES COMMUNITY COLLEGE DISTRICT

Reports that have eminated from the National Science Foundation sponsored study of science education in the Los Angeles Community College District are listed below. These reports are available in the ERIC system.

Friedlander, Jack. Student Participation and Success in Los Angeles Community College District Science Courses (ED number to be assigned).

Friedlander, Jack. Science Courses Participated in and Completed by Students at Each of the Colleges in the Los Angeles Community College District (ED number to be assigned).

Friedlander, Jack. Enrollment, Completion, and Success in Los Angeles Community College District Science Courses (ED number to be assigned).

Friedlander, Jack. The Initial Science Course: Its Relationship to Enrollment and Success in Later Science Courses (ED number to be assigned).